Merging Conflict Study for SR 167 at the South 212th St. Interchange

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Introduction

Studies have consistently shown significant reductions in accidents at locations where ramp meters have been installed. However, to get meaningful results from an accident study one has to wait a few years for enough accidents to analyze. We wanted to measure something more immediate and so chose to conduct a conflict study on SR 167 at S 212th St. The conflict study looked at when vehicles in the merge area of a ramp had to make a maneuver to avoid each other, either by braking or changing lanes.

Data Collection

The following three categories of maneuvers were recorded in 5-minute intervals:

1) Primary conflicts - when either the merging vehicle or the adjacent mainline vehicle brake to avoid each other. An example would be car #1 entering the freeway from the on-ramp. Car #2 adjacent to it on the mainline brakes to allow #1 room to merge. This would be counted as a primary conflict.

2) Secondary conflicts - those that are ultimately caused by a primary conflict. An example would be cars #3 and #4 behind the above car #2 are forced to brake and each would be counted as a secondary conflict.

3) Lane changes – when a vehicle makes a lane change to avoid a braking maneuver. Car #5 (behind the above car #4) changes lanes to avoid braking and is counted in the lane change category.

The basic idea was to obtain a baseline by gathering data before the ramp meters were activated on April 3, 2000. The locations for data collection were the onramps from S 212th St to northbound SR 167 in the mornings and from S 212th St to southbound SR 167 in the afternoons. The dates of the *before* data collection were March 22, 23, 28, 29, and 30. After the meters were activated, more data were gathered at the same location and time period on April 12, 13, 18, 19, and 20.

Results

The 5-minute intervals were averaged for the 5 days of *before* and *after*, and an hourly total was used for comparison. In the mornings the study period was from 6:45 to 7:45; in the afternoons it was from 2:15 to 3:15. The results are summarized in the table below.

AM Conflict Results at S 212th St to NB SR 167				
	Primary	Secondary	Lane Change	**Total**
Before	109.6	267.1	13.0	389.7
After	83.4	56.2	12.0	151.6
Difference	26.2	210.9	1.0	238.1
% Change	**23.9%**	79.0%	7.7%	61.1%

PM Conflict Results at S 212th St to SB SR 167				
	Primary	Secondary	Lane Change	**Total**
Before	93.9	57.2	23.2	174.3
After	74.5	57.6	25.8	157.9
Difference	19.5	-0.4	-2.7	16.4
% Change	**20.7%**	-0.6%	-11.5%	9.4%

The morning ramp metering caused a significant drop in primary and secondary conflicts and a negligible drop in lane changes. There was a total conflict reduction of 61% in the morning.

Afternoon ramp metering also resulted in a significant drop in primary conflicts, while secondary conflicts and lane changes displayed negligible increases. The data for the secondary conflicts and lane changes may be skewed due to the location of the data collection site. The data collection site is located in the gore area, which is best for observing primary conflicts but not for lane changes. When an observer is occupied with primary conflict counts, most of the lane change maneuvers took place prior to and out of view from the observation point. The same problem occurred with secondary conflict counts. The brake lights could not be seen—and therefore counted—until a vehicle had passed the gore point. Another thing that occasionally skewed the data is that the traffic queue extended back from downstream. Whenever that happened the counts were discontinued, but some of them may have already been registered.

In conclusion, there is a definite reduction in primary conflicts due to ramp meters. However, it appears that ramp metering has little effect on lane changing maneuvers.

SAFETY ANALYSIS

Accident Data Collection

To investigate how ramp meters influence safety, accident data for both northbound and southbound SR 167 were gathered for 1996 to 1999. The data were then filtered to include only those accidents occurring within the conflict study area and during morning and evening peak hours when ramp meters would normally be activated. Below is a table summarizing the accident data:

Northbound SR 167	1996	1997	1998	1999	Annual Average
Rear-ended / Front-ended	8	3	3	5	5
Lane change / Side swipe	1	1	3		2
Miscellaneous	2		5	8	5

Southbound SR 167	1996	1997	1998	1999	Annual Average
Rear-ended / Front-ended	15	22	8	11	14
Lane change / Side swipe	1	1	6	1	2
Miscellaneous	2	1	1	1	1

Projection of Accident Reduction

Applying the averages of the primary conflict reduction rate from the conflict study [(23.9% + 20.7%) / 2 = 22.3%] to the above annual accident rates [(5 + 2) for northbound and (14 + 2) for southbound] yields a projected accident reduction for future years due to ramp meters. If the annual accident rate holds, ramp metering would result in accident reductions of two for northbound SR 167 and four for southbound SR 167, as shown below.

Northbound SR 167	Projected annual accident reduction
Rear-ended / Front-ended / Lane change / Side swipe	2

Southbound SR 167	Projected annual accident reduction
Rear-ended / Front-ended / Lane change / Side swipe	4

Secondary conflicts and lane changes were not used because of inconsistency between the rates produced as well as the possibly skewed southbound data.